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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/580,394	05/22/2006	Kyung Sang Cho	PHO0024US	1954

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EXAMINER	
BREVAL, ELMITO	
ART UNIT	PAPER NUMBER
2889	

NOTIFICATION DATE	DELIVERY MODE
07/21/2010	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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Office Action Summary	Application No.	Applicant(s)	
	10/580,394	CHO ET AL.	
	Examiner	Art Unit	
	ELMITO BREVAL	2889	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *07 June 2010*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-5 and 7-10* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-5 and 7-10* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

The amendment filed on 06/07/2010 has been entered.

Continued Examination Under 37 CFR 1.114

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 06/07/2010 has been entered.

Response to Arguments

Applicant's arguments are as follows:

(1), Jain (US. Pat: 6,797,412) does not disclose "an inorganic quantum dot light-emitting layer provided between the top electrode and the bottom electrode; and an inorganic electron transport layer disposed between the inorganic quantum dot light emitting layer and the top electrode" as claimed in independent claims 1 and 10.

(2), Jain ('412) does not disclose the newly amended limitation "an organic hole transport layer is disposed between the inorganic quantum dot light-emitting layer and the bottom electrode" as claimed in the independent claim 1.

(3), Bulovic et al., (US. Pub: 2004/0023010) does not disclose or suggest "an inorganic quantum dot light-emitting layer provided between the top electrode and the bottom electrode; and an inorganic electron transport layer disposed between the

inorganic quantum dot light-emitting layer and the top electrode" as claimed in independent claims 1 and 10.

(4), Kishigami (JP: 2000-215984) does not cure the deficiencies of Bulovic because Kishigama does not disclose, teach or suggest: "an inorganic quantum dot light emitting layer provided between the top electrode and the bottom electrode; and an inorganic electron transport layer disposed between the inorganic quantum dot light-emitting layer and the top electrode" as claimed in independent claims 1 and 10.

Examiner's responses to Applicant's arguments are as follows:

(1), The secondary reference Jain ('412) teaches (in at least fig. 7; col. 5, lines 48-59) an inorganic quantum dot light-emitting device comprised of, in part, an insulator substrate (30), a bottom electrode (31), a p-type semiconductor (32; i.e. the hole transport layer) to inject holes into the CNC semiconductor (33), wherein the CNC semiconductor is made of materials selected from ZnCdSe/ZnSe or ZnCdSe/ZnSSe (col. 5, lines 1-3); and a hole blocking layer (34; i.e. the electron transport layer) is formed on the CNC by thin layers of semiconductors or insulators such as Ta2O5, ZnxMg1-xS, ZnxBe1-xS, etc. or their combination; and a metal electrode (35) is formed on top of the hole blocking layer (34). Therefore, Jain does teach an inorganic quantum dot light-emitting layer provided between the top electrode and the bottom electrode; and an inorganic electron transport layer disposed between the inorganic quantum dot light emitting layer and the top electrode as claimed in independent claims 1 and 10.

(2), this argument is moot in view of the new ground of rejection.

(3), The primary reference Bulovic ('010) teaches (in at least fig. 1 and claim 20) a quantum dot light emitting device comprising: a top electrode (5); a bottom electrode (2) disposed substantially opposite the top electrode; an inorganic quantum dot light emitting layer (not shown; [0027]) provided between the top electrode and the bottom electrode; and an electron transport layer (4) is disposed on the inorganic quantum dot light emitting layer and the top electrode is formed on top of the electron transport layer. The secondary reference above, Jain ('214) teaches an inorganic electron transport layer is formed on the quantum dot light emitting layer between the two electrodes. Therefore, Bulovic ('010) as modified by Jain ('214) does disclose an inorganic quantum dot light-emitting layer provided between the top electrode and the bottom electrode; and an inorganic electron transport layer disposed between the inorganic quantum dot light-emitting layer and the top electrode as claimed in the independent claims 1 and 10.

Also, the examiner notes that the applicant is arguing the figures which the examiner did not use in the office action. For instance, the applicant is arguing figure 2A-2B of Bulovic, while the Examiner specifically mentioned figure 1 and the corresponding paragraphs in the office action.

(4), The examiner notes that Kishigami (JP: 2000-215984) is not relied upon to disclose an inorganic quantum dot light emitting layer provided between the top electrode and the bottom electrode; and an inorganic electron transport layer disposed between the inorganic quantum dot light-emitting layer and the top electrode as claimed in the independent claims 1 and 10. As shown above, Jain discloses that limitation.

Kishigami is relied upon to show that an inorganic electron transport layer made of materials selected from the same group as the applicant.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

The factual inquiries set forth in *Graham* v. *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

Claims 1-2, 4-5 and 8-9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bulovic et al., (US. Pub: 2004/0023010) of record in view of Jain et al., (US. Pat: 6,797,412) of record.

Regarding claim 1, Bulovic ('010) teaches (in at least fig. 1; claim 20) a quantum dot light emitting device comprising: a top electrode (5); a bottom electrode (2) disposed substantially opposite the top electrode; an inorganic quantum dot light emitting layer (not shown; [0027]) provided between the top electrode and the bottom electrode; and an electron transport layer (4) is disposed on the inorganic quantum dot light emitting

layer and the top electrode (5) is formed on top of it; and an organic hole transport layer (3) is disposed between the inorganic quantum dot light emitting layer (not shown) and the bottom electrode (2), wherein the organic hole transport layer is made of material selected from the group consisting of TPD ([0029]).

However, Bulovic ('010) does not disclose the electron transport layer is inorganic.

Further regarding claim 1, Jain ('412) in the same field of endeavor teaches (in at least fig. 7) a quantum dot light emitting device comprised of, in part, an inorganic electron transport layer (col. 5, lines 56-59; i.e. the hole blocking layer) for the purpose of enhancing the electron injection to the light emitting device and to improve the luminance efficiency of the device.

Hence, it would have been obvious to one of ordinary skill in the art at the time the invention was made to contemplate of using the inorganic electron transport layer of Jain in the device of Bulovic for the purpose of enhancing the electron injection to the light emitting device and to improve the luminance efficiency of the device.

Regarding claim 2, Bulovic ('010) as modified by Jain ('412) teaches (in at least fig. 1 of Bulovic) the quantum dot light-emitting diode further comprises: a substrate (1) disposed beneath the bottom electrode (2), wherein the organic hole transport layer (3; [0029]) is disposed on the bottom electrode (2), wherein the bottom electrode (2) is an anode and the top electrode (5) is a cathode, wherein the anode (2), the organic hole transport layer (3), the inorganic quantum dot light emitting layer (not shown in the fig. [0027]; see at least claim 20), the inorganic electron transport layer (see at least fig. 7 of

Jain; item 34; col. 5, lines 56-59) and the cathode (5) are formed in this order on the substrate (1).

Regarding claim 4, Bulovic ('010) teaches (in paragraph [0033]) the inorganic quantum dot light emitting layer is made of a material selected from the group consisting of: group III-V compound nanocrystals including CdS, CdSe, ZnS, ZnTe, HgS, HgSe and HgTe.

Regarding claim 5, the limitation "inorganic electron transport layer is formed by a solution coating process selected from the group consisting of sol-gel coating, spin coating, printing casting and spraying, or a vapor coating process selected from the group consisting of chemical vapor (CVD), sputtering, e-beam evaporation and vacuum deposition" is a product-by-process limitation. In spite of the fact a product-by-process may recite process limitations; it is the product not the recited process that is covered by the claim. Furthermore, patentability of a claim to a product does not rest merely in the difference in the method by which the product is made. Rather, it is the product itself which must be new and not obvious. It the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a difference process. In re Thorpe, 777 F. 2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985).

Regarding claim 8, Bulovic ('010) teaches (in paragraph [0033]) the inorganic quantum dot light emitting layer is made of a material selected from the group consisting of: group III-V compound nanocrystals including CdS, CdSe, ZnS, ZnTe, HgS, HgSe and HgTe.

Regarding claim 9, the limitation “inorganic electron transport layer is formed by a solution coating process selected from the group consisting of sol-gel coating, spin coating, printing casting and spraying, or a vapor coating process selected from the group consisting of chemical vapor (CVD), sputtering, e-beam evaporation and vacuum deposition" is a product-by-process limitation. In spite of the fact a product-by-process may recite process limitations; it is the product not the recited process that is covered by the claim. Furthermore, patentability of a claim to a product does not rest merely in the difference in the method by which the product is made. Rather, it is the product itself which must be new and not obvious. It the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a difference process. In re Thorpe, 777 F. 2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985).

Claims 3, 7, and 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bulovic et al., (US. Pub: 2004/0023010) of record in view of Jain et al., (US. Pat: 6,797,412) of record as applied to claims 1-2, 4-5, and 8-9 above in further view of Kishigami (JP: 2000-215984) of record.

Regarding claim 3, Bulovic ('010) as modified by Jain ('412) teaches all the claimed limitations except for the the inorganic electron transport layer includes an oxide selected from group consisting of TiO2, ZnO, SiO2, SnO2, WO3, Ta2O3, BaTiO3, BaZrO3, ZrO2, HfO2, Al2O3, Y2O3, and ZrSiO4; the nitride Si3N4; or a semiconductor compound selected from the group consisting of CdS, ZnSe and ZnS.

However, Jain ('412) teaches (in col. 5, lines 54-59) the hole blocking (i.e. electron transport) can be achieved by thin layers of semiconductors or insulators such as Ta2O5, ZnxMg1-xS, ZnxBe1-xS, etc.. or their combination.

Further regarding claim 3, Kishigami ('984) teaches a light emitting device comprised of, in part, an inorganic electron transport layer made of materials selected from ZnO, CdS for the purpose of enhancing the electron injection to the light emitting device and to improve the luminance efficiency of the device.

At the time of invention, it would have been obvious to one of ordinary skill in the art to use the inorganic electron transport materials of Kishigami in place of the electron transport materials of Bulovic as modified by Jain for the purpose of enhancing the electron transportability to the light emitting layer and to improve the luminance efficiency of the device.

Regarding claim 7, Kishigami ('984) teaches (in [0028]) the inorganic electron material is selected from CdS, ZnO. The reason for combining is the same as for claim 3.

Claim 10 is rejected under 35 U.S.C. 103(a) as being unpatentable over Bulovic et al., (US. Pub: 2004/0023010) of record in view of Kishigami (JP: 2000-215984) of record.

Regarding claim 10, Bulovic ('010) teaches (in at least fig. 1) a quantum dot light emitting device comprising: a top electrode (5); a bottom electrode (2) disposed substantially opposite the top electrode; an inorganic quantum dot light emitting layer (not shown; [0027]) provided between the top electrode and the bottom electrode; and

an electron transport layer (4) is disposed on the inorganic quantum dot light emitting layer, and the top electrode is disposed on the electron transport layer.

However, Bulovic ('010) does not disclose the electron transport layer is inorganic; wherein the inorganic electron transport layer includes an oxide selected from group consisting of TiO2, ZnO, SiO2, SnO2, WO3, Ta2O3, BaTiO3, BaZrO3, ZrO2, HfO2, Al2O3, Y2O3, and ZrSiO4; the nitride Si3N4; or a semiconductor compound selected from the group consisting of CdS, ZnSe and ZnS.

Further regarding claim 10, Kishigami ('984) teaches (abstract) a light emitting device comprised of, in part, a luminescent layer (4), an inorganic electron transport layer (3) disposed between the luminescent layer (4) and a top electrode (2); and wherein the electron transport layer comprises a material selected from the group consisting of CdS and ZnO ([0028] for the purpose of enhancing the electron injection to the light emitting device and to improve the luminance efficiency of the device.

Hence, it would have been obvious to one of ordinary skill in the art at the time the invention was made to contemplate of replacing the electron transport layer of Bulovic with the inorganic electron transport layer of Kishigami for the purpose of enhancing the electron injection to the light emitting device and to improve the luminance efficiency of the device.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to ELMITO BREVAL whose telephone number is (571)270-3099. The examiner can normally be reached on M-F (8:30 AM-5:00 Pm).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Toan Ton can be reached on (571)-272-2303. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Bumsuk Won/
Primary Examiner, Art Unit 2889

July 6, 2010
/Elmito Breval/
Examiner, Art Unit 2889